

**STATE**

(Rev. 5-18-15)  
 (Rev. 11-16-15)  
 (Rev. 6-27-16)  
 (Rev. 12-2-16)  
 (Rev. 5-15-17)  
 (Rev. 11-6-17)  
 (Rev. 5-14-18)

**OF****TENNESSEE**

January 1, 2015

**Supplemental Specifications - Section 900****of the****Standard Specifications for Road and Bridge Construction****January 1, 2015**

**Subsection 901.01** (pg. 918), 5-14-18; Add the following sentence as the second paragraph of the subsection:

Provide hydraulic cement, selected from the Department's QPL, which conforms to the following for the kind and type specified or allowed:

Portland cement.....AASHTO M 85  
 Portland blast-furnace slag cement (Type IS) AASHTO M 240  
 Portland-pozzolan cement (Type IP).....AASHTO M 240  
 Portland-limestone cement (Type IL) .....AASHTO M 240

All cements and blended cements must conform to the "equivalent alkalis" (low-alkali cement) requirements of Table 2 in ASHTO M85.

**Subsection 903.01** - Table 903.01-1 (pg. 920), 5-18-15; Replace Note (1) with the following:

“(1)If the fine aggregate is manufactured from crushed stone and if material finer than the No. 200 sieve consists of the dust of fracture, essentially free from clay or shale, this limit may be increased to 5%.

**Subsection 903.01** - Table 903.01-1, Table 903.01-2 (pg. 921), 5-15-17; replace Tables 903.01-1 and 903.01-2 with the following Tables:

**Table 903.01-1: Limits of Deleterious Substances in Fine Aggregate for Concrete**

<b>Substance</b>	<b>Maximum Permissible Limits Percent by Weight</b>
Clay Lumps	0.5
Coal and Lignite	0.5
Material Passing the No. 200 Sieve <sup>(1)(3)</sup>	3.0
Other deleterious substances (such as shale, alkali, mica, coated/grains, soft and flaky particles) <sup>(1)(2)</sup>	3.0
<sup>(1)</sup> If the fine aggregate is manufactured from crushed stone and if material finer than the No. 200 sieve consists of the dust of fracture, essentially free from clay or shale, this limit may be increased to 10%. <sup>(2)</sup> Determine other organic impurities according to AASHTO T 267. <sup>(3)</sup> If the fine aggregate is manufactured from crushed gravel and if material finer than the No. 200 sieve consists of the dust of fracture, essentially free from clay or shale, this limit may be increased to 3.5%.	

**Table 903.01-2: Gradation Requirements for Fine Aggregate**

<b>Sieve Size</b>	<b>Total Percent Passing by Weight</b>
3/8 inch	100
No. 4	95-100
No. 16	50-90
No. 50	5-35
No. 100	0-20
No. 200 <sup>(1)</sup>	0-3
<sup>(1)</sup> If the fine aggregate is manufactured from crushed stone and if material finer than the No. 200 sieve consists of the dust of fracture, essentially free from clay or shale, this limit may be increased to 10%.	

**Subsection 903.03** (pg. 922) 5-15-17; Coarse Aggregate for Concrete, add the following as the 4<sup>th</sup> paragraph:

“Coarse aggregate in two-lift composite pavements shall consist of Size No. 467 in the lower lift, graded as specified in 903.22. Coarse aggregate in the upper lift shall be Size No. 57 or 67 graded as specified in 903.22 and shall meet 903.24 riding surface requirements.”

**Subsection 903.03** (pg. 922-923) 11-16-15; Coarse Aggregate for Concrete, modify the 4<sup>th</sup> and 5<sup>th</sup> paragraphs, update Table 903.03-1: Coarse Aggregate Sizes to the following:

“Coarse aggregate in Portland cement concrete bridge decks and overlays on interstates and four or more lane highways consisting of Size No. 57 shall meet 903.24.

The coarse aggregates for travel lanes and bridge decks shall be crushed and consist of stone, slag, gravel, quartzite, gneiss, or combination thereof with an absorption of plus 4 material not to exceed 5%. Do not use uncrushed gravel, pea gravel, or any other uncrushed particles. Crushed gravel, if used, shall consist of siliceous washed particles after processing, of which at least 70% by count of the material retained on the No. 4 sieve contains a minimum of two fractured faces. One face shall be fractured for the approximate average diameter or thickness of the particle.”

Table 903.03-1

<b>Application</b>	<b>Coarse Aggregate Size <sup>(1)</sup></b>
Structural concrete	No. 57
Self-Consolidating concrete	Maximum-No.67
Prestressed concrete	No. 57 or 67
Precast concrete	Any size fraction
Concrete curbing placed by machine-extrusion methods	No. 7, 57, 67, or 78
Cement treated permeable base <sup>(2)</sup>	No. 57
<sup>(1)</sup> Gradation shall conform to <b>903.22</b> .	
<sup>(2)</sup> Aggregate shall meet the quality requirements specified below.	

**Subsection 903.03-2** (pg. 924) 5-15-17; Revise Table 903.03-2: Limits of Deleterious Substances in Coarse Aggregate for Concrete, update Material passing No. 200 Sieve and Footnote 2:

**Table 903.03-2: Limits of Deleterious Substances in Coarse Aggregate for Concrete**

Substance	Maximum Percent by Weight
Soft or non-durable fragments (fragments that are structurally weak such as shale, soft sandstone, limonite concretions, gypsum, weathered schist, or cemented gravel), and organic impurities as determined by AASHTO T 267 <sup>(1)</sup>	3
Coal and lignite <sup>(1)</sup>	1
Clay lumps <sup>(1)</sup>	0.25
Material passing the No. 200 sieve <sup>(1)(2)</sup>	1.5
Thin or elongated pieces (length greater than 5 times average thickness)	10
Other local deleterious substances <sup>(1)</sup>	1
<sup>(1)</sup> The sum of the percentages of these materials (i.e., soft or non-durable fragments, coal and lignite, clay lumps, material passing the No. 200 sieve, and other local deleterious substances) shall not exceed 5.0.	
<sup>(2)</sup> For crushed aggregate, if all the material finer than the No. 200 sieve, as determined in accordance with AASHTO T 11, consists of the dust of fracture, essentially free of clay or shale, this limit may be increased to 2.0.	

**Subsection 903.05 – B. Type B Aggregate** (pg. 927), 5-18-15; Replace the 1<sup>st</sup> paragraph of subsection 3. With the following:

- “3. Do not use material having clay content greater than 12%, as determined by hydrometer analysis performed in accordance with AASHTO T 88. Material may be used having a clay content exceeding 12% if a plasticity index-fines product does not exceed 3 when calculated by the following formula”

**Subsection 903.05 – Aggregate for Mineral Aggregate Base and Surface Courses** (pg. 928) 5-15-17; add section C to the bottom:

**C. Reclaimed Concrete Aggregate.** Provide material comprised of concrete reclaimed from the demolition of a concrete structure or pavement. Reclaimed Concrete Aggregate may only be used as a mineral aggregate base course, subbase or shoulder course. The material shall be free of any materials classified as Solid or Hazardous Waste, especially asbestos, lead and mercury, with test results submitted by the contractor to the Project Supervisor. These test results shall be certified and notarized. The percentage of wear as determined in accordance with AASHTO T 96 shall not exceed 50. Deleterious substances shall be kept to a minimum, and may not be higher than the amounts listed on Table 903.05-3.

Table 903.05-3: Deleterious Materials

Material	Maximum Permissible Limits Percent by Weight
Brick	5
Bituminous Concrete Materials	5
Weathered Rock	2
Wood	0.1
Metals	0.1

The gradations of the coarse and fine fractions of aggregate shall be such that, when combined in proper proportions, the resultant mixture will fall within the grading specified in Table 903.05-4.

Table 903.05-4: RCA Grading Tolerances

Sieve Size	Total Percent Passing per Weight
1 ½ inch	100
1 inch	85-100
¾ inch	60-95
3/8 inch	50-80
No. 4	40-65
No. 16	20-40
No. 100	5-18

**Subsection 903.05** – Aggregate for Mineral Aggregate Base and Surface Courses (pg. 925) 5-15-17; add reference to subsection **903.05 C.** in the second paragraph of subsection A.:

**“903.05 Aggregate for Mineral Aggregate Base and Surface Courses**

Provide crushed stone, crushed slag, crushed or uncrushed gravel, or crushed or uncrushed chert that may be blended with crushed recycled concrete or screened reclaimed asphalt pavement (RAP), together with material such as manufactured sand or other fine materials that are either naturally contained or added as needed to conform to these Specifications.

Provide aggregate of Types A and B, as specified below.

**A. Type A Aggregate**

Provide hard, durable particles or fragments of stone, slag, gravel, or chert, and other finely divided mineral matter.

The Contractor may use recycled concrete aggregate **per 903.05 C.** or reclaimed asphalt pavement, at a maximum rate of 25% by weight, for Type A aggregate, provided the combined aggregate blend meets all the requirements specified below. Crush and screen the recycled concrete and asphalt to produce a uniform stockpile before blending it with the virgin material. Keep the recycled stockpiles free of bricks, steel, wood, and all other deleterious materials. “

**Subsection 903.05** – Aggregate for Mineral Aggregate Base and Surface Courses (pg. 925-926) 5-15-17; add reference to subsection **903.05 C.** in the second paragraph of subsection B.:

“For Provide crushed or uncrushed gravel, crushed or uncrushed chert, crushed stone or crushed slag, and other finely divided particles.

The Contractor may use recycled concrete aggregate **per 903.05 C.** or reclaimed asphalt pavement, at a maximum rate of 30% by weight, for Type B aggregate, provided the combined aggregate blend meets all the requirements specified below. Crush and screen recycled concrete and asphalt to produce a uniform stockpile before blending it with the virgin material. Keep the recycled stockpiles free of bricks, steel, wood, and all other deleterious materials.”

**Subsection 903.06 - C. Combined Aggregate Grading** (pg. 930) 11-16-15; add the following sentence at the end of the first paragraph:

“For mixtures including recycled asphalt pavement, RAP, and/or recycled asphalt shingles, RAS, stockpiles will not be considered as contributing to the required minimum of three stockpile sizes.”

**Subsection 903.11 - Aggregate for Asphaltic Concrete Surface Coarses (Hot Mix)** (pg. 934) 11-16-15; add the following sentence at the end of the first paragraph:

“For mixtures including recycled asphalt pavement, RAP, and/or recycled asphalt shingles, RAS, stockpiles will not be considered as contributing to the required minimum of three stockpile sizes.”

**Subsection 903.11** (pg. 934) 11-16-15; A. Coarse Aggregate (retained on a No. 4 sieve), revise the 1<sup>st</sup> paragraph and subsection 3:

“Provide aggregate, consisting of crushed stone, crushed slag, crushed gravel, crushed granite, crushed quartzite, crushed gneiss, or natural combinations of these materials.”,

“3. Combined aggregate shall consist of siliceous particles processed from washed material, of which at least 70% by count of the material retained on the No. 4 sieve shall have a minimum of two fractured faces, one of which must be fractured for the approximate average diameter or thickness of the particle. Do not add pea gravel or uncrushed particles. The absorption of the crushed aggregate retained on the No. 4 sieve shall not exceed 5% when tested in accordance with AASHTO T 85.”

**Subsection 903.11 - A. Coarse Aggregate** (retained on a No. 4 sieve) (pg. 934), 5-18-15; revise subsection 2. as follows:

“2. Material retained on the No. 4 sieve shall contain a maximum of 10% elongated pieces (length greater than five times the average thickness)”

**Subsection 903.11 C.3.** (pg. 938), 6-27-16; revise the 1<sup>st</sup> paragraph of subsection C.3 to the following:

**“3. Grading OGFC.** A minimum of 75% of the aggregate shall meet the requirements specified in 903.24 for Surface Mixtures (Non-Skid Aggregates). The coarse aggregate shall have at least 90% crushed aggregate with two fractured faces and 100% with one fractured face as determined in accordance with ASTM D5821. The coarse aggregate shall have a LA Abrasion value of less than 40% and a maximum absorption of 3.0%.”

**Subsection 903.11** (pg. 938), 12-2-16; Add the following to C. as subsection 5.:

**“5. Grading C, CS, CW.** The mixture shall meet all requirements of **903.06**. When using Grading C, CS, or CW as a final riding surface for traffic lanes and the design ADT is greater than 1000, a minimum of 75% of the aggregate shall meet the requirements specified in **903.24** for Surface Mixtures (Polish-Resistant Aggregate) for the appropriate levels.”

**Subsection 903.12** (pg. 938) 11-16-15; A. Aggregate for Slurry Seal, revise the 1<sup>st</sup> paragraph a A. as shown; delete the 2<sup>nd</sup> paragraph:

“The aggregate shall be crushed slag, crushed granite, or crushed stone (crushed stone as specified in 903.24), meeting the requirements of ASTM D692, except the gradation shall be as specified in Table 903.12-1. The aggregate shall have a minimum sand equivalent, as determined in accordance with AASHTO T 176, of 45.

**Subsection 903.12** (pg. 939) 11-16-15; B. Aggregate for Micro-Surface: modify the first paragraph, delete the second paragraph:

“The aggregate shall be crushed slag, crushed granite, or crushed stone (crushed stone as specified in **903.24**) meeting the gradation limits specified in Table 903.12-2 and the physical properties of ASTM D692, except the percent of fractured pieces shall be 100. The aggregate shall have a minimum sand equivalent, as determined in accordance with AASHTO T 176, of 65. Polish-resistant aggregates will not be required for leveling courses, provided they will be covered with riding surface mixtures.

**Subsection 903.12** (pg. 939) 5-15-17; B. Aggregate for Micro-Surface: Add the following as the 2<sup>nd</sup> paragraph:

“If blending aggregates from more than one source, use automated proportioning and blending equipment which has individual bins for each aggregate source used to produce a stockpile meeting the job mix formula gradation. Proportion and blending equipment shall be calibrated at the beginning of production. All aggregate sources shall meet the requirements of **Table 903.24-1**. Do not blend aggregates with a front end loader. Proportion the aggregate to produce a uniform gradation meeting the requirements specified in Table 903.12-2. The contractor shall provide a Type A laboratory as defined by **106.06** capable of verifying gradation at the location where blending occurs.”

**Subsection 903.13** (pg. 940), 12-2-16; modify the last sentence of the 1<sup>st</sup> paragraph:

“Provide aggregate consisting of crushed stone, crushed slag, or crushed gravel, meeting the quality requirements of ASTM D692, except that at least 50% by count of crushed gravel aggregates shall have at least one fractured face. Crushed slag aggregate retained on the No. 4 sieve shall contain no more than 20% by weight of glassy particles. Provide aggregates meeting the requirements of **903.24 except, if ADT is less than 1000.**”

**Subsection 903.15** (pg. 941), 5-15-17; revise the 3<sup>rd</sup> paragraph:

“The Contractor may use recycled concrete aggregate per 903.05 C. or reclaimed asphalt pavement (RAP), at a maximum rate of 25% by weight; provided the combined aggregate blend meets all the requirements specified above. If blending, crush and screen the recycled concrete and/or asphalt to produce a uniform stockpile before blending it with the virgin material. Keep the reclaimed asphalt pavement stockpiles free of bricks, steel, wood, and all other deleterious materials. The virgin and reclaimed pavement blend shall meet the quality requirements specified in Table **903.05-1.**”

**Subsection 903.24** (pg. 946), 5-18-15; Modify the 1<sup>st</sup> paragraph to the following:

“Provide coarse aggregate consisting of crushed gravel, crushed granite, crushed slag, crushed quartzite, crushed gneiss, or crushed sandstone. Other crushed aggregate may be used provided it has the chemical, physical, and performance characteristics specified in Table 903.24-1.”

**Subsection 904.01** (pg. 948) 11-16-15; Asphalt Cements, add the following between the 4<sup>th</sup> and 5<sup>th</sup> paragraphs:

“Polyphosphoric acid may be used as a modified not exceeding 0.5% by weight of asphalt binder and may only be used when the primary modifier is one of the styrene-based products listed above.”

**Subsection 904.01** (pg. 948) 11-6-17; Asphalt Cements, modify the fourth paragraph with the following:

“To modify the asphalt, properly blend one or more modifier(s) consisting of styrene butadiene (SB), styrene butadiene styrene (SBS), or styrene butadiene rubber (SBR), or Ground Tire Rubber (GTR) to a PG 64-22 or PG 67-22 base asphalt.

GTR used to modify asphalt shall meet the requirements of 921.17. Blending of GTR into asphalt cement shall occur only at the asphalt terminal. ”

**Subsection 904.01** (pg. 948), 11-6-17; Asphalt Cements, add the following paragraph as the next to last paragraph:

“In addition to the above, asphalt cement modified with GTR shall meet the following requirement. The temperature difference determined by the Separation Test shall not exceed 15 °F. The separation test shall consist of taking the difference in softening point,



as determined by the Ring and Ball Test (AASHTO T53), between the top and bottom thirds of a specimen prepared per ASTM D7173.”

**Subsection 904.01** (pg. 949), 12-2-16; Modify Table 904.01-1:

**“Table 904.01-1: Requirements for Asphalt Cement**

Property*	PG 64- 22, PG 67-22	PG 70- 22	PG 76- 22	PG 82- 22
Non-recoverable creep compliance at 3.2kPa, Jnr(3.2), kPa <sup>-1</sup> at 64°C, Max	4.5	1.0	0.5	0.5
% Difference in Non-Recoverable Creep Compliance, Jnr(diff) at 64°C, %, Max	75	75**	n/a	n/a

\* Tested in accordance with AASHTO T350.

\*\* Shall be waived if Jnr(3.2) is equal to or less than 0.5

PG76-22 and PG82-22 grade asphalts shall meet the requirements for Indication of Elastic response as defined in Appendix X1 of AASHTO M332. PG70-22 grade asphalts shall have a minimum percent recovery at 3.2 kPa of 29%.”

**Subsection 904.01** (pg. 948-950) 5-18-15; revise the 1st paragraph to add the word cement, add sentence to the end of the 2<sup>nd</sup> paragraph, add “cement high-temperature grade properties to the 4<sup>th</sup> paragraph, remove the grades of asphalts and add asphalt cements to the 5<sup>th</sup> paragraph, update Table 904-01-1 to remove “Ring and Ball” and” Elastic Recovery”, add “Non-recoverable creep compliance” requirements to Table 904-01-1, add footnote to Table, add a 6<sup>th</sup> paragraph, remove A. Test Procedures and Table 904.01-2, remove Materials Certification header, remove 8<sup>th</sup> paragraph, and revise the 9<sup>th</sup> paragraph:

“Only obtain asphalt cement for use on Department projects from Certified Asphalt Cement Suppliers that have an approved Quality Control Plan in accordance with the Department’s Standard Operating Procedures.

Asphalt cement shall conform to AASHTO M 320 and Department procedures. Direct Tension testing is not required.

Instead of PG 64-22, the Contractor may use asphalt cement graded to PG 67-22. PG 67-22 shall conform to the requirements of AASHTO M 320 when the applicable tests are conducted at 67 °C and -12 °C, and the dynamic shear of the rolling thin film, pressure aged vessel sample is tested at 26.5 °C.

To modify the asphalt cement high-temperature grade properties, properly blend styrene butadiene (SB), styrene butadiene styrene (SBS), or styrene butadiene rubber (SBR) to a PG 64-22 or PG 67-22 base asphalt.

In addition to the above requirements, asphalt cements shall meet the requirements specified in Table 904.01-1.

**Table 904.01-1: Requirements for Asphalt Cement**

Property*	PG 64-22, PG 67-22	PG 70-22	PG 76-22	PG 82-22
Non-recoverable creep compliance at 3.2kPa, $J_{nr}(3.2)$ , $kPa^{-1}$ at 64°C, Max	4.5	1.0	0.5	0.5
% Difference in Non-Recoverable Creep Compliance, $J_{nr}(diff)$ at 64°C, %, Max	75	75	75	75

\* Tested in accordance with AASHTO T350.

All modified grades shall meet the requirements for Indication of Elastic response as defined in Appendix X1 of AASHTO M332.

Furnish a certification to the Engineer on each project stating that the asphalt cement provided meets the Department's specification. Ensure that quality control and compliance testing are completed in accordance with the asphalt supplier's approved quality control plan and Department procedures.

In addition, the asphalt cement supplier shall provide a temperature-viscosity curve for PG 64-22 and PG 67-22 asphalt cements with a recommended mixing temperature range. In order to develop a temperature-viscosity curve, it may be necessary to run the viscosity test at a higher temperature, based on the softening point of the modified asphalt cement."

**Subsection 904.01**(pg. 949), 6-27-16; Modify Table 904.01-1:

Table 904.01-1: Requirements for Asphalt Cement

Property	PG64-22			
	PG67-22	PG 70-22	PG 76-22	PG 82-22
Non-recoverable creep compliance at 3.2kPa, Jnr(3.2), kPa <sup>-1</sup> at 64°C, Max	4.5	1.0	0.5	0.5
% Difference in Non-Recoverable Creep Compliance, Jnr(diff) at 64°C, %, Max	75	75	75	n/a

**Subsection 904.01 B.** (pg. 949) 11-6-17; Asphaltic Cements, B. Materials Certification, add the following as the last sentence of the first paragraph:

“Furnish a certification to the Engineer on each project stating that the asphalt cement provided meets the Department’s specification. Ensure that quality control and compliance testing are completed in accordance with the asphalt supplier’s approved quality control plan and Department procedures. Identify on the certification, the type(s) of modifier used.”

**Subsection 904.03** (pg. 951) 11-16-15; Emulsified Asphalts, Add “TTT-3” to 904.03-1 with the following requirements:

Saybolt-Furol Viscosity @ 77 °F, seconds	10-100
Particle Charge	Positive
Sieve Test, %	0.1 Max
Residue by	Distillation <sup>(1)</sup>
Residue, %	50 Min
Demulsibility, %	65 Min
Penetration	40-90

<sup>1</sup>-Distill at 350°F

**Subsection 904.03** (pg. 954), 12-2-16; Revise Table 904.03-1(c) to remove TTT-1, TTT-2, and TTT-3:

Table 904.03-1(c): Test Requirements for Emulsified Asphalt

Practices	AASHTO Test Method	CRS-2P	RS-2	RS-1
Saybolt-Furol Viscosity @ 77 °F, seconds	T59	n/a	n/a	20-100
Saybolt-Furol Viscosity @ 122 °F, seconds	T59	100-400	75-400	n/a
Storage Stability Test, 24- h, %	T59	1 Max	1 Max	1 Max
5-day Settlement, %	T59	n/a	n/a	n/a
Particle Charge	T59	Positive	n/a	n/a
Sieve Test, %	T59	0.1 Max	0.1 Max	0.1 Max
Residue by	T59	<i>Evaporation</i>	Distillation	Distillation
Residue, %	T59	65 Min	63 Min	55 Min
Demulsibility, %	T59	40 Min	60 Min	60 Min
Distillate, %	T59	n/a	n/a	n/a
Oil Test, %	T59	n/a	n/a	n/a
Stone Coating	T59	n/a	n/a	n/a
Float Test, seconds	T50	n/a	n/a	n/a
Penetration	T49	75-175	100-200	100-200

Practices	AASHTO Test Method	CRS-2P	RS-2	RS-1
Elastic Recovery, % (2)	T301	50 Min	n/a	n/a
Ductility @ 77 °F, cm	T51	40 Min	40 Min	40 Min
Ductility @ 40 °F, cm	T51	n/a	n/a	n/a
R&B Softening Point, °F	T53	125 Min	n/a	n/a
Original G*/sind @ 82 °C	T315	n/a	n/a	n/a

**Subsection 904.03** (pg.954), 5-18-15; Replace with the following:

**Subsection 904.03, Table 904.03-1(c). Modify** as follows for TTT-1, TTT-2:

**Table 904.03-1(c): Test Requirements for Emulsified Asphalt**

Practices	AASHTO Test Method	CRS-2P	RS-2	RS-1	TTT-1	TTT-2
Saybolt-Furol Viscosity @ 77 °F, seconds	T59	n/a	n/a	20-100	20-100	10-100
Saybolt-Furol Viscosity @ 122 °F, seconds	T59	100-400	75-400	n/a	n/a	n/a
Storage Stability Test, 24- h, %	T59	1 Max	1 Max	1 Max	1 Max	1 Max
5-day Settlement,	T59	n/a	n/a	n/a	n/a	n/a

<sup>(2)</sup> Straight-sided mold, 20-cm elongation, 5min hold, 25 °C

**Subsection 905.01** (pg. 956) 5-14-18, Revise subsection, add part C. Polypropylene Foam Type:

**“905.01 Preformed Joint Fillers (Non-Extruding and Resilient Types)**

Provide preformed joint fillers ~~of the bituminous type unless otherwise as~~ shown on the Plans. When designated, punch holes in preformed joint filler to admit the dowels.

Furnish the filler for each joint in a single piece for the full depth and width required for the joint unless otherwise directed by the Engineer. If the Engineer approves the use of more than one piece for a joint, fasten the abutting ends securely, and hold to shape by stapling or using other positive means of fastening satisfactory to the Engineer.

**A. Bituminous Type**

Provide bituminous type preformed joint fillers conforming to AASHTO M 213.

**B. Non-Bituminous Types**

Provide non-bituminous types of preformed joint filler conforming to AASHTO M 153, Type I, II, or III, as specified.

~~Furnish the filler for each joint in a single piece for the full depth and width required for the joint unless otherwise directed by the Engineer. If the Engineer approves the use of more than one piece for a joint, fasten the abutting ends securely, and hold to shape by stapling or using other positive means of fastening satisfactory to the Engineer.~~

**C. Polypropylene Foam Type**

Provide semi-rigid, closed-cell, polypropylene foam, preformed expansion joint filler conforming to ASTM D8139, ~~when shown on the plans or pre-approved by the Engineer as an alternate to the (A.) Bituminous Type or (B.) Non Bituminous Types.”~~

**Subsection 908.04** (pg. 968), 5-18-15, High Strength Bolts, A. Specifications; Add the following to the first paragraph:

“Unless otherwise shown on the Plans, mechanically galvanize all bolts, nuts and washers in accordance with ASTM B695 Class 50.”

**Subsection 908.04** (pg. 968), 12-2-16, High Strength Bolts, A. Specifications; revise the first paragraph:

“Unless otherwise shown on the Plans, all bolts, nuts and washers shall be coated with acceptable coating in accordance with ASTM F3125 for the respective grade.”



**Subsection 908.04** (pg. 968) 12-2-16; revise A. Specifications, 1.:

“A. Specifications: 1. Bolts. ASTM F3125, Grade 325 and Grade 490 - High Strength Bolts for Structural Joints”

**Subsection 908.04** (pg. 970) 12-2-16; Revise C. Testing, 3. Assemblies, subsection f., update Table 908-04-2:

C. Testing, 3. Assemblies, f. Table 908.04-2 The minimum rotation, from a snug tight condition (10% of the specified proof load), shall be as specified in Table 908.04-2.

**Table 908.04-2: Rotation from Snug Tight Condition**

<b>Bolt Length</b>	<b>Minimum Rotation from Snug</b>
Up to and including 4 diameters	240 degrees (2/3 turn)
Over 4 diameters, but not exceeding 8 diameters	360 degrees (1 turn)
Over 8 diameters	480 degrees (1-1/3 turn)

(Note: These values differ from those shown in ASTM F3125.)

**Subsection 908.07** (pg. 973), 5-14-18; Add the following as the last sentence in the subsection:

“Furnish the Engineer a certification from the manufacturer identifying each heat number and certifying that the requirements from AASHTO M 105 and the above additions have been met.”

**Subsection 909.02**(pg. 977), 12-2-16; Remove the 4<sup>th</sup> paragraph referencing a tolerance of 5% from B. Steel Posts and Braces.

**Subsection 909.02** (pg. 980-981), 12-2-16; Remove the word minimum from Table 909.02-1:

**Table 909.02-1: Post and Braces**

<b>Application</b>	<b>Material</b>	<b>ASTM Specification</b>	<b>Nominal Diameter (inches)</b>	<b>Outside Diameter (inches)</b>
Line Posts	Galvanized steel pipe	F1083	1.5	1.900
	Aluminum alloy	B429, Alloy 6063,	1.5	1.900

<b>Application</b>	<b>Material</b>	<b>ASTM Specification</b>	<b>Nominal Diameter (inches)</b>	<b>Outside Diameter (inches)</b>
	standard (ANSI Schedule 40) pipe	Temper T6		
	Triple coated steel pipe with a 0.120-inch wall thickness	F1043, Group I-C	1.5	1.900

<b>Application</b>	<b>Material</b>	<b>ASTM Specification</b>	<b>Nominal Diameter (inches)</b>	<b>Outside Diameter (inches)</b>
End, Corner, and Pull Posts	Galvanized standard steel pipe	F1083	2.0	2.375
	Aluminum alloy standard (ANSI Schedule 40) pipe	B429, Alloy 6063, Temper T6	2.0	2.375
	Triple coated steel pipe with a 0.130-inch wall thickness	F1043, Group I-C	2.0	2.375
End and Corner Braces	Galvanized standard steel pipe	F1083	1.25	1.660
	Aluminum alloy standard (ANSI Schedule 40) pipe	B429, Alloy 6063, Temper T6 (for corner posts: B241)	1.25	1.660
	Triple coated steel pipe with a 0.111-inch wall thickness	F1043, Group I-C	1.25	1.660

**Subsection 909.03** (pg. 983), 12-2-16; Remove the last paragraph of the subsection.

**Subsection 912.05** (pg. 1001), 6-27-16; Add subsection 912.05 – Brick Paving Units:

**“912.05 Brick Paving Units**

Provide brick of the kind and grade specified.

#### **A. Masonry Brick**

1. Sidewalk: ASTM C902, Class SX, Type 1
2. Crosswalks and Roadway: ASTM C1272, Type R

#### **B. Concrete Brick and Truncated Dome Concrete Brick**

Provide brick conforming to ASTM C936

#### **C. Truncated Dome Brick**

Provide brick conforming to ASTM C902, Class SX, Type 1”

**Subsection 915.02** (pg. 1007), 6-27-16; modify the description of 915.03, remove zinc coated, iron from 915.02 A. update the first paragraph of 915.02 A., Remove subsection B. Aluminum Coated Steel Pipe, Revise C. to become B., revise D to become C, Remove 1<sup>st</sup> and 2<sup>nd</sup> paragraphs of D now C, revise E to become D, update 915.03 to match index title: :

### **“SECTION 915 – METALLIC PIPE**

915.01 Ductile Iron or Cast Iron Pipe .....	1007
915.02 Corrugated Metal Pipe Culverts, Pipe Arches, and Underdrains.....	1007
915.03 Polymer Pre-coated, Corrugated Steel Pipe, Culverts, and Underdrains....	1008

#### **915.01 Ductile Iron or Cast Iron Pipe**

Provide ductile iron pipe conforming to ASTM A716 for the specified diameters and strength classes. Unless otherwise specified, either smooth, corrugated, or ribbed pipe may be furnished. For pipe diameters in excess of 48 inches, conform to ANSI Standard for Cast Iron Pit Cast Pipe, or as otherwise specified in the Contract, for the specified diameter and strength class.

Provide cast iron drain pipe conforming to ASTM A74. Unless otherwise specified, provide ductile iron pressure pipe for water lines or sewer construction conforming to the requirements of ASTM A377 for the diameters and working pressures specified.

#### **915.02 Corrugated Metal Pipe Culverts, Pipe Arches, and Underdrains**

##### **A. Corrugated Steel Pipe, Pipe Arches, and Underdrains**

Provide corrugated steel pipe, pipe arches, or underdrains, including special sections, such as elbows and flared ends, that conform to AASHTO M 36, aluminum-coated Type 2 meeting AASHTO M274. Special Sections shall be the same thickness as the pipe, arch, or underdrain to which they are joined. Furnish shop-formed elliptical pipe and shop-strutted pipe only where shown on the Plans.

##### **B. Corrugated Aluminum Pipe, Pipe Arches, and Underdrains**

When using corrugated aluminum pipe, pipe arches, or underdrains, conform to the applicable requirements of AASHTO M 196. Use special sections, such as elbows and flared end sections that conform to the applicable requirements of AASHTO M 196 and that are of the same gauge as the conduit to which they are joined.

### C. Structural Plate Corrugated Steel and Aluminum Structures

Corrugated aluminum alloy structural plate for pipe, pipe arches, and arches shall conform to the requirements of AASHTO M 219.

### D. Bituminous Coating

When material supplied for any of the items specified above are to be bituminous-coated, ensure that the metal to be coated is free of grease, dirt, and other contaminants. Bituminous coating and paving shall conform to the requirements of AASHTO M 190. Apply the coating in accordance with the manufacturer's recommended procedures and as directed by the Department."

### 915.03 Polymer Pre-coated, Corrugated Steel Pipe, Culverts and Underdrains

Provide polymer pre-coated corrugated steel pipe conforming to AASHTO M 245, Grade 250/250, unless otherwise specified."

**Subsection 916.05 E.** (pg. 1012); 12-2-16, Add sentence to first paragraph:

"Fabricators must be AISC certified as specified in **602.04 A.4.**"

**Subsection 917.02.A.6.** (pg. 1023), 6-27-16; Revise the following:

**"6. Anchor Bolts.** Use anchor rods of high strength steel meeting the requirements of ASTM F 1554, Grade to be determined by design. Fit each anchor bolt with a hex nut and lock-washer."

**Subsection 918.01** (pg. 1033-1035), 5-14-18; Revise the 1<sup>st</sup> paragraph and 3<sup>rd</sup> paragraph of A. General, Revise Table 918.01-1, Table 918.01-2, Table 918.01-4, Table 918.01-5, Revise the last paragraph of B. Seed Groups, Revise Table 918.01-6 Temporary Seeding:

#### A. General

Provide seed meeting the rules and requirements of the Tennessee Department of Agriculture. ~~The Engineer will accept no "Below Standard" seed. Chapter 0080-05-06.~~

Pack grass seed in new bags or bags that are sound and not mended.

The vendor shall notify the Department before making shipments to allow the Department to arrange for inspection and testing of stock.

The vendor shall furnish the Department a certified laboratory report from ~~an~~ Society of Commercial Seed Technologists accredited commercial seed laboratory or from a State seed laboratory showing the analysis of the seed to be furnished. The report from an accredited

commercial seed laboratory shall be signed by a Registered Member of the Society of Commercial Seed Technologists. The Department may take samples of the seed to check against the certified laboratory report. Sampling and testing will be in accordance with the requirements of the Tennessee Department of Agriculture.

Use commercial grade 10-10-10 fertilizer or equivalent.

### B. Seed Groups

When a seed group is used, provide mixtures meeting the requirements specified in Tables 918.01-1 through 918.01-5, unless otherwise specified.

**Table 918.01-1: Group A (February 1-July 1)**

Kind of Seed	Quantity, Percent by Weight
Kentucky 31 Fescue	80
Korean Lespedeza	15
<del>English Annual</del> Rye <del>Grass</del>	5

**Table 918.01-2: Group B (June 1-August 15)**

Kind of Seed	Quantity, Percent by Weight
Kentucky 31 Fescue	<del>75</del>
<del>English Rye</del>	<del>20</del>
Korean Lespedeza	15
German Millet	10

**Table 918.01-3: Group B1 (April 15 - August 15)**

Kind of Seed	Quantity, Percent by Weight
Bermudagrass (hulled)	70
Annual Lespedeza	30

**Table 918.01-4: Group C (August 1-December 1)**

Kind of Seed	Quantity, Percent by Weight
Kentucky 31 Fescue	70
<del>English Annual</del> Rye <del>Grass</del>	20
White Clover	10

**Table 918.01-5: Group C1 (February 1-December 1)**

Kind of Seed	Quantity, Percent by Weight
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<del>Crown Vetch</del>	25
Kentucky 31 Fescue	70
<u>English Annual Rye Grass</u>	5

Uniformly mix seed when forming Groups. Do not mix Group seed until each type seed that is used to form the Group has been tested ~~and inspected~~ separately and ~~approved-meets DOA requirements~~ for purity and germination ~~by the Department. Seed mixed before tests and inspection are made will not be accepted.~~

### C. Over-Seeding

Groups A, B, and C, when sown on slopes 3:1 and steeper, shall be over seeded with Sericea Lespedeza at the rate of 15 pounds per acre. When over-seeding is performed between February 1 and July 1, use Scarified Sericea Lespedeza with an additional 2 pounds per acre of Weeping Lovegrass. Between July 1 and December, use unhulled Sericea Lespedeza. Only use Group C1 when shown on the Plans.

### D. Temporary Seeding

For temporary seeding, use seed groups and approved varieties as specified in Table 918.01-6.

**Table 918.01-6: Temporary Seeding**

Seed Group (Season)	Kind of Seed	Percent by Weight
<b>Group D</b> (January 1 – May 1)	<del>Italian Annual Rye Grass</del>	33-1/3%
	Korean Lespedeza	33-1/3%
	<del>Summer-Spring Oats</del>	33-1/3%
<b>Group E (May 1 – July 15)</b>	<del>Sudan-Sorghum</del> <u>Sorghum-</u> <u>Sudan</u> Crosses <sup>(1)</sup>	100%
	or <del>Starr-German</del> Millet <sup>(2)</sup>	100%
<b>Group F</b> <b>July 15 – January 1</b>	<del>Balboa-Cereal</del> Rye	66-2/3%
	<del>Italian Annual Rye Grass</del>	33-1/3%

<sup>(1)</sup> ~~Dekalb Sudan SX11, Lindsey 77F, TN Farmer's Co-op GHS 1 or GHS 2A.~~

<sup>(2)</sup> ~~Starr Millet, GaHi 1~~

**Subsection 918.04** (pg. 1036), 12-2-16; add as a 2<sup>nd</sup> paragraph:

“For small quantities less than 100 units of seeding or sod, bagged pelletized or agricultural limestone meeting the Department of Agriculture Tennessee Liming Materials Act may be utilized.”

**Subsection 921** (pg. 1049), 11-6-17, Section 921 – Miscellaneous Materials, add Ground Tire Rubber to the Index:

“921.17 Ground Tire Rubber .....1060”

**Subsection 921.01** (pg. 1049), 5-18-15, Water; Replace subsection with the following:

“For mixing concrete, use water that is reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter, and other substances injurious to the finished product. Water provided by a municipal utility may be used without testing.

All other water shall have quality results submitted in accordance with the frequency listed in Table 921.01-01. All water quality results shall adhere to Table 921.01-2.

**Table 921.01-1 Testing Frequency for Mixing Water**

Water Source	Testing Frequency <sup>(1)</sup>
Municipal	NA
Non-Municipal	Every 3 months; tested annually after 4 consecutive passing tests

(1) The frequency may vary at the discretion of the Department.

**Table 921.01-2 Quality Requirements for Mixing Water**

Maximum Concentration in Mixing Water	Limits	ASTM Test Method <sup>(1)</sup>
Chloride Ion Content, ppm	500	C114
Alkalies as (NaO2 + 0.658 K2O), ppm	600	C114
Sulfates as SO4, ppm	3000	C114
Total Solids by mass, ppm	50000	C1603
pH	4.5-8.5	<sup>(2)</sup>
Resistivity, Minimum, kohm-cm	0.500	D1125
Soluble Carbon Dioxide, ppm	600	D513
Calcium and Magnesium, ppm	400	D511
Iron, ppm	20	<sup>(2)</sup>
Phosphate, ppm	100	D4327

(1) Other methods (EPA or those used by water testing companies) are generally acceptable.

(2) No ASTM method available.



**Subsection 921.01** (pg. 1049), 5-14-18, Water; Remove Resistivity, Soluble Carbon Dioxide, Calcium and Magnesium, Iron, and Phosphate from Table 921.01-2 Quality Requirements for Mixing Water:

**Table 921.01-2 Quality Requirements for Mixing Water**

Maximum Concentration in Mixing Water	Limits	ASTM Test Method <sup>(1)</sup>
Chloride Ion Content, ppm	500	C114
Alkalies as (NaO2 + 0.658 K2O), ppm	600	C114
Sulfates as SO4, ppm	3000	C114
Total Solids by mass, ppm	50000	C1603
pH	4.5-8.5	(2)
<del>Resistivity, Minimum, kohm-cm</del>	<del>0.500</del>	<del>D1125</del>
<del>Soluble Carbon Dioxide, ppm</del>	<del>600</del>	<del>D513</del>
<del>Calcium and Magnesium, ppm</del>	<del>400</del>	<del>D511</del>
<del>Iron, ppm</del>	<del>20</del>	<del>(2)</del>
<del>Phosphate, ppm</del>	<del>100</del>	<del>D4327</del>

(1) Other methods (EPA or those used by water testing companies) are generally acceptable.

(2) No ASTM method available.

**Subsection 921.06** (pg.1051) 11-16-15; B. Bituminous Additives - 1. Anti-Stripping Additive, replace the ASTM C977 reference with AASHTO M 303.

“Use hydrated lime conforming to AASHTO M 303 or other heat-stable asphalt anti-stripping additive containing no ingredient harmful to the bituminous material or the workmen and that does not appreciably alter the specified characteristics of the bituminous material when added in the recommended proportions.”

**Subsection 921.06 B. Bituminous Additives** (pg.1052) 10-10-16; revise the 3<sup>rd</sup> paragraph to the following:

“When using an anti-stripping additive other than hydrated lime, use a dosage rate of 0.3%, unless either gravel is used as a coarse aggregate or test results indicate moisture susceptibility, in which case mix at a dosage rate of 0.5%.

**Subsection 921.06 B. 2.** (pg. 1052) 11-6-17; B. Bituminous Additives, 2. Silicone Additives, Remove description and add the following sentence:

“2. Silicone Additives. The amount of silicone added to asphalt cement shall not exceed 2 oz. of silicone per 5500 gallons asphalt cement.”

**Subsection 921.17** (pg. 1060) 11-6-17; Ground Tire Rubber, add the following subsection:

**“921.17 Ground Tire Rubber**

Provide Class 30-1 Ground Tire Rubber (GTR) as defined by ASTM D5630 except for as noted in table 921.17-1. The material shall also be certified to meet the requirements of Table 921.17-01. Include certification of the GTR with the bill of lading for the modified asphalt cement.

**Table 921.17-1: Requirements for Ground Tire Rubber**

Property	Specification
Specific Gravity	1.15 +/- 0.05
Moisture Content	0.75% Max
Ferrous Metal Content	0.01% Max
Fiber Content	0.5% Max
Ash (ASTM E1131)	10% Max